

# **TL06 345 kV Underground Transmission**

**Scott Newland**  
**Burns & McDonnell**

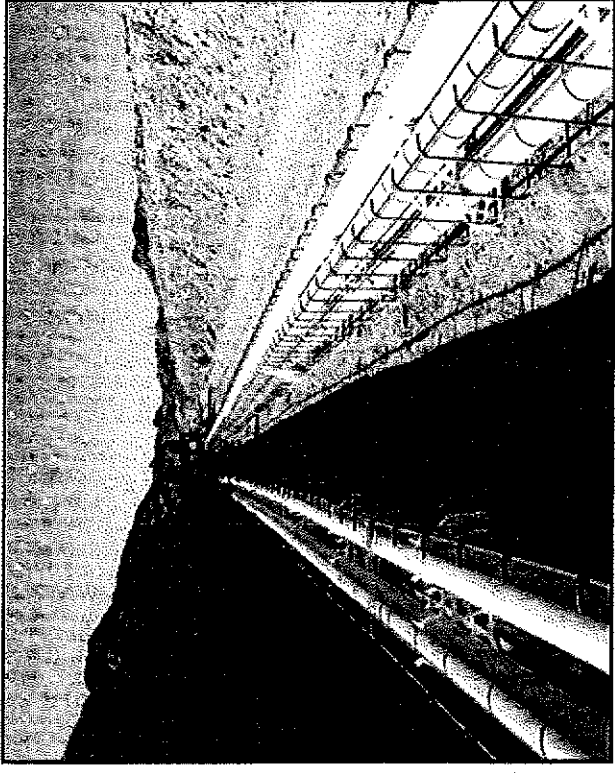


Exhibit 14.d

# TL06

## Presentation Overview

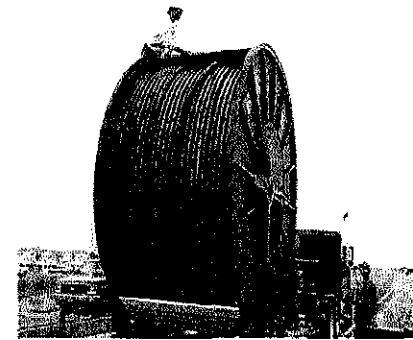
- Cable Types
- Design Constraints and Concerns
- Construction



# TL06



## Cable Types



Cable Type	Maximum Voltage	Electrical Advantages	Electrical Disadvantages
High-pressure Fluid-filled (HPFF)	345kV +	Most Common at >230kV	Higher VAR Consumption, Leaking oil
High-pressure Gas-filled (HPGF)	138kV	Lower Capacitance	Higher VAR Consumption, Uncommon
<b>Extruded-dielectric (XLPE)</b>	<b>345kV +</b>	<b>Higher Rating than HPFF, Lower VAR Consumption, Low Maintenance</b>	<b>New to the United States at 345kV+</b>
Extruded-dielectric (EPR)	138kV	More Flexible than XLPE	Higher Electrical Losses than XLPE
Self-contained Fluid-filled (SCFF)	345kV +	High Voltages	Dielectric Fluid, Higher VAR Consumption than XLPE, Uncommon

# Typical XLPE Double Circuit Duct Bank



**TL06**

# Splice Vault In-Street Installation

www.mhfi.com

11/11/2011

11/11/2011

# TL06

## Vault Locating Constraints

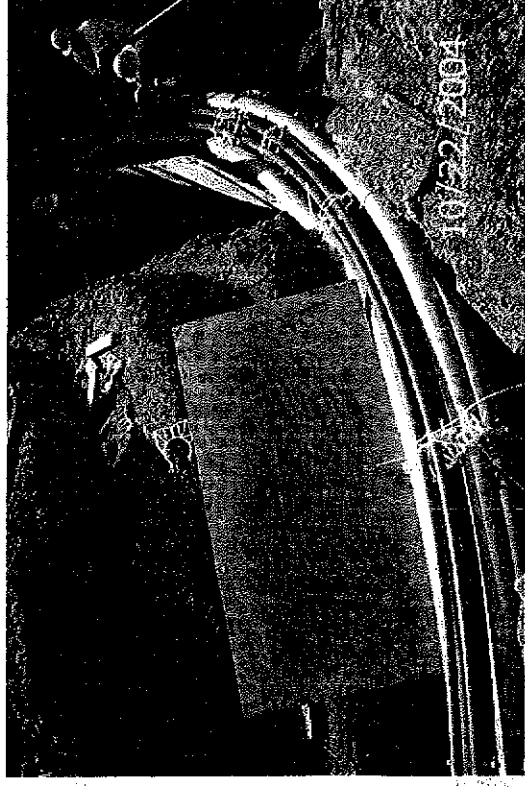
- Reel Size
- Pulling Lengths
- Single Circuit Vaults vs. Double Circuit Vaults
- Cross Bonding vs. Multiple Single Point Bonding
- Within vs. Out of Travelway



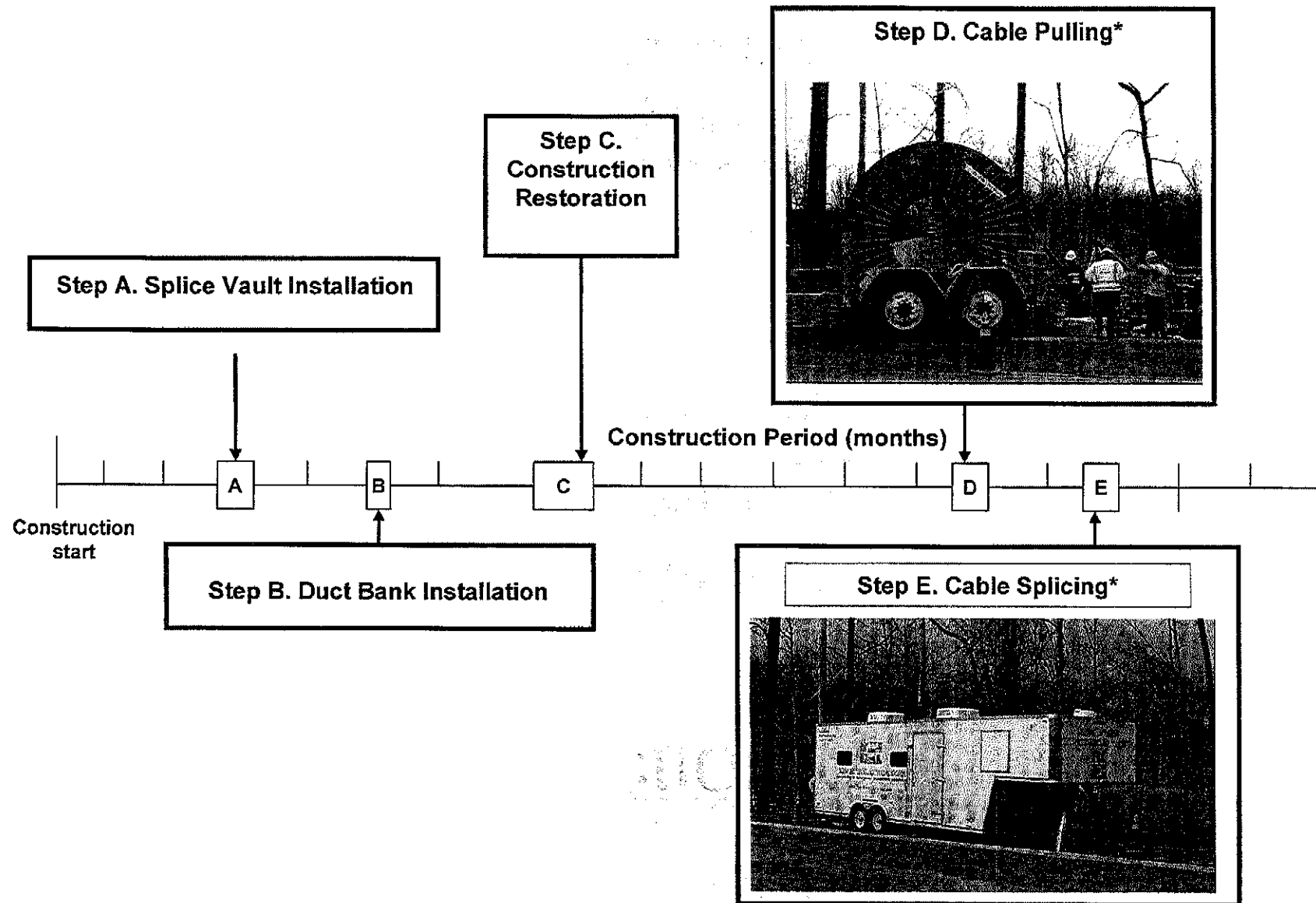
# TL06

## Civil Design Considerations

- Water and Railroad Crossings
- Existing Utilities
- Other Heat Sources
- Survey and Subsurface Utility Engineering
- Geotechnical Investigations
  - Characterization of Soils
  - Thermal Resistivity
  - Rock
  - Water



# TL06 Construction Sequencing



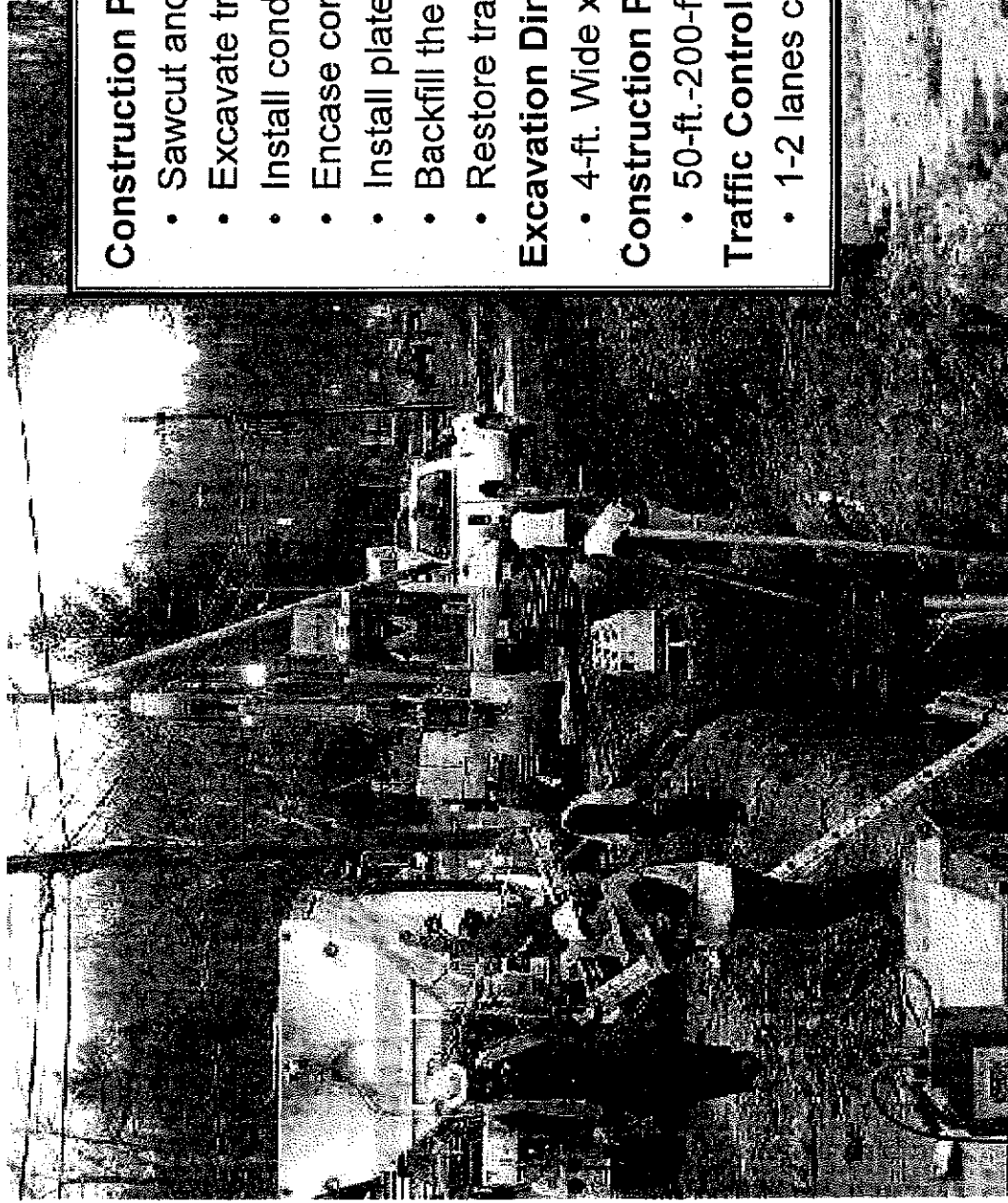


# TL06 Splice Vault Excavation and Installation

- **Excavation Dimensions:**
  - 14-ft. wide x 14-ft. deep x 36-ft. long
- **Construction Duration:**
  - 7-14 days to install 2 vaults working nights
  - Or, 2-4 days of 24 hour shifts
- **Traffic Control:**
  - 2-3 lanes closed during construction



# TL06 Duct Bank Excavation and Installation



## Construction Procedures:

- Sawcut and remove pavement
- Excavate trench
- Install conduits
- Encase conduits in concrete
- Install plate system
- Backfill the trench
- Restore traffic flow

## Excavation Dimensions:

- 4-ft. Wide x 6'-14' Deep

## Construction Pace:

- 50-ft.-200-ft./day

## Traffic Control:

- 1-2 lanes closed during construction



# TL06

## Cable Pulling



### Construction Setup:

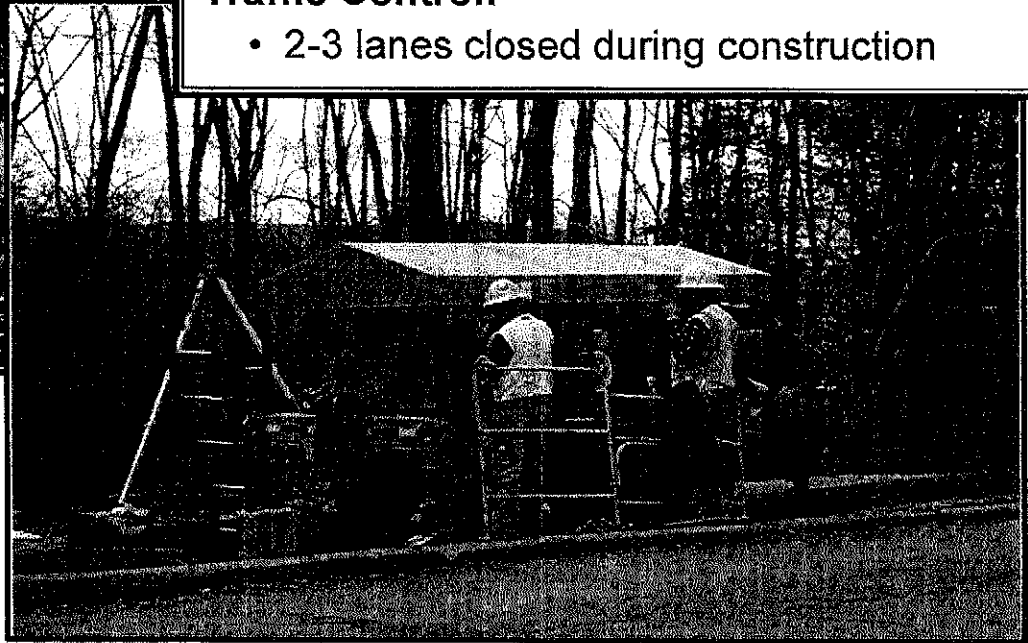
- Pulling machines and reel carts setup over installed splice vaults

### Construction Duration:

- 6 days to pull cables/set of vaults

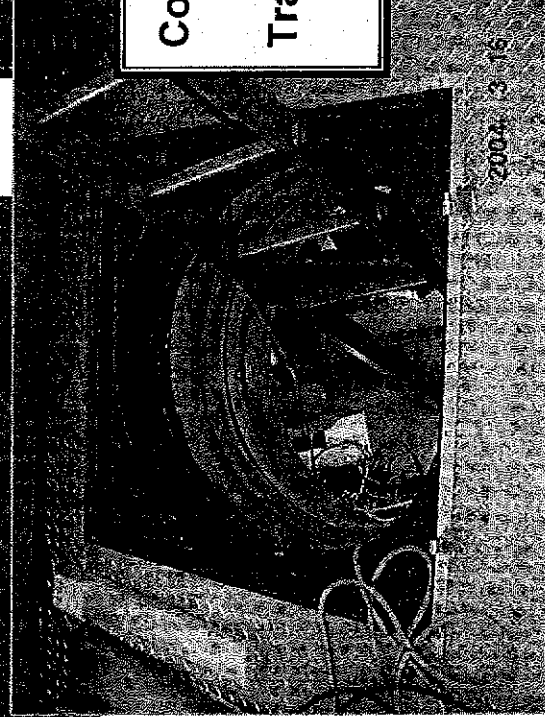
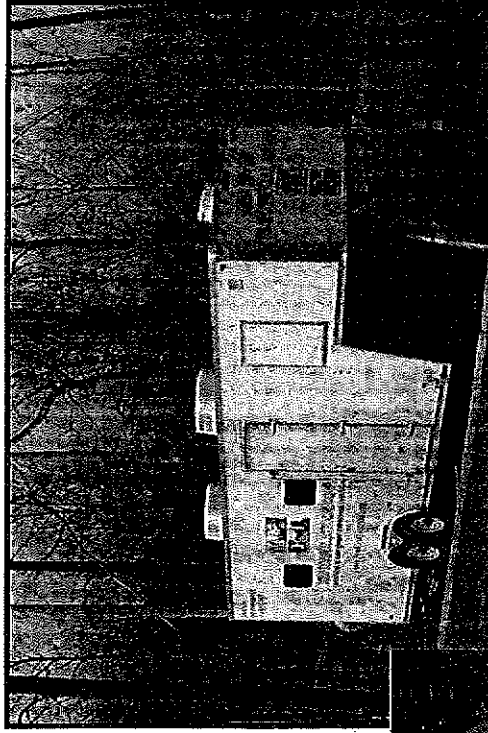
### Traffic Control:

- 2-3 lanes closed during construction



# TL06

## Cable Splicing



### Construction Duration:

- 24 days/set of vaults

### Traffic Control:

- 1-2 lanes closed during construction



# **TL06**

## **Underground Transmission is the Future**

- **Hard Costs & Soft Costs**
- **Feeling the Hurricane Hurt**
- **More is on the way!**

